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Proceedings of the
DFO Taxonomic Standards Workshop

Compte rendu d'un atelier taxonomique de
normes de DFO

16-17 January 2008
Institute of Ocean Sciences
Sidney, British Columbia

Les 16-17 janvier 2008
Institut des sciences de la mer
Sidney, Colombie-Britannique

Mary Kennedy
Meeting Chair

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Présidente de la réunion

July 2009

juillet 2009

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

This workshop was not carried out as a formal Department of Fisheries and Oceans (DFO) Science Advisory process, but as a DFO National Science Data Management project. The objective of the workshop was to discuss and build the framework for implementing taxonomic standards across Science data management. Because taxonomic nomenclature is of interest in the advisory process, this workshop report is being documented in the Canadian Science Advisory Secretariat (CSAS) Proceedings series.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

Le présent atelier n'a pas été tenu dans le cadre officiel du processus des avis scientifiques du ministère des Pêches et des Océans (MPO). Celui-ci est toutefois documenté dans la série des comptes rendus du Secrétariat canadien de consultation scientifique (SCCS), car il couvre certains sujets en lien avec le processus des avis.

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SUMMARY

A Department of Fisheries and Oceans (DFO) taxonomic workshop held at the Institute of Ocean Sciences in Sidney, British Columbia, in January of 2008 provided a forum for DFO regional representatives to share their knowledge of 'species lists'. Participants at the workshop included a mixture of taxonomists, biological oceanographers, computer programmers, and data managers.

This workshop focused on data management aspects of taxonomic lists and not on taxonomy. It was acknowledged that although synonyms do exist within taxonomic nomenclature, it is not the data manager's mandate to update this information. However, it is their mandate to provide the means to link to sources of this information. A method proposed at the workshop is to map species names to a standard code such as the Integrated Taxonomic Information System's code, ITIS.TSN. By linking to ITIS, data managers can obtain the latest accepted/valid name. This 'accepted' name could change next week - if it does, then it is up to ITIS to update the taxonomic information.

One topic discussed at the workshop was the fact that many of our marine taxonomic names are not yet in ITIS and, therefore, cannot be assigned a standard code. Collaboration between ITIS and DFO data managers is required to overcome this problem.

The second topic of discussion centred around quality control of species lists and registers of marine species (RMS). A RMS is a list of all species found within a defined area. Existing local and international registers were described. It was acknowledged that DFO should build and maintain regional registers, and a design for a Canadian register of marine species was drafted and implementation plans were discussed.

SOMMAIRE

Un atelier sur la taxonomie organisé en janvier 2008 par le ministère des Pêches et des Océans (MPO) à l'Institute cf Ocean Sciences de Sidney, en Colombie-Britannique, a permis à des représentants des Régions du MPO de partager leurs connaissances sur les « listes d'espèces ». Participaient à cet atelier, des taxonomistes, des océanographes biologistes, des programmeurs en informatique et des gestionnaires de données, entre autres.

Cet atelier portait sur l'aspect gestion des données des listes taxonomiques et non sur la taxonomie proprement dite. Les participants ont convenu que, bien qu'il existe des synonymes dans la nomenclature taxonomique, il n'appartient pas aux gestionnaires de données de mettre l'information à jour. En revanche, les gestionnaires de données doivent fournir des moyens d'accès aux sources de l'information en question. L'une des solutions proposées lors de l'atelier serait de faire correspondre aux noms d'espèces un code normalisé comme le code TSN du Système d'information taxonomique intégré (SITI). En consultant le SITI, les gestionnaires de données peuvent obtenir le nom le plus récemment accepté pour une espèce. Ce nom peut changer, toutefois, si c'est le cas, c'est au SITI qu'il incombe de mettre à jour l'information taxonomique.

L'un des sujets évoqués lors de l'atelier est que bon nombre des noms taxonomiques de nos espèces marines ne figurent pas encore au SITI. On ne peut donc pas leur attribuer de code normalisé. Les gestionnaires de données du MPO devront collaborer avec les représentants du SITI pour remédier à cette situation.

Le deuxième sujet de discussion concernait le contrôle de la qualité des listes d'espèces et des registres des espèces marines (REM). Un REM est une liste de toutes les espèces présentes dans une zone donnée. Des registres locaux et internationaux existants ont été décrits. Les participants ont convenu que le MPO devrait créer et tenir des registres régionaux. Par ailleurs, on a ébauché un modèle de registre canadien des espèces marines et discuté des plans de mise en oeuvre du futur registre.

EXECUTIVE SUMMARY

Scientific research and related activities are vital to the understanding and sustainable management of Canada's oceans and aquatic resources. This is a mandate of the Department of Fisheries and Oceans (DFO). Data management decisions must be made at the national level, if collections from different research projects are to be shared and/or compared. The questions that this workshop's objectives were designed to address were: "How do we standardize?" and "How do we maintain quality control of taxonomic name lists contained in biological collections?"

The National Science Data Management Committee provided funding to host a workshop to discuss regional taxonomic issues and to propose a solution that would be beneficial to all DFO research. Each of the seven regions within DFO was requested to send at least one representative. The location of the workshop in British Columbia enabled additional participation from Pacific region data managers.

The Workshop included talks that covered the following topics:
- Regional reports detailing programs and species lists.
- International initiatives, standards, and data exchange.
- Registers of species - what are they and what should DFO create and maintain?

Workshop participants agreed that a standard code was required if data managers wished to share and/or clean species lists. ITIS (Integrated Taxonomic Information System) was adopted as this standard code, and for species list names that did not have a match in ITIS, then the standard code used should be the Ocean Biogeographic Information System Canada (OBIS Canada) Master Negative TSN code.

Participants also agreed with the concept of using a local species register to QA/QC regional species lists. These discussions also led to the following recommendations:
- Design a database structure for Canadian local registers of species.
- Populate registers for the Atlantic and Pacific regions.
- Assign responsibilities related to maintenance and support of local and national registers.
- Prepare request for continued funding from the NSDMC.
- Document proceedings so that they can be referenced.

These recommendations will be submitted to the NSDMC along with a request for implementation funding support.

INTRODUCTION

In January of 2008, a Department of Fisheries and Oceans (DFO) taxonomic workshop was held at the Institute of Ocean Sciences in Sidney, British Columbia. This workshop provided a forum for DFO regional representatives to share their knowledge of 'species lists'.

The meeting commenced with a round table of introductions. Each participant was requested to share not just their name and regional affiliation, but to provide information related to their personal area of expertise as it related to taxonomy. For example, "Are they first and foremost a biologist, a taxonomist, a computer programmer or a data manager? What geographical area does their work cover? What taxonomic groups do they work with? What is needed in their

field? What other initiatives are they involved in?" A listing of all participants and a summary of their comments is contained in Appendix I.

This workshop was to focus on data management aspects of taxonomic lists and not on taxonomy. The agenda for the meeting is contained in Appendix II. To make life simpler for all, a list of acronyms is contained in Appendix III.

As the meeting progressed a list of action items was compiled. See Appendix IV.

TAXONOMIC STANDARDS

If it is acknowledged that biological collections will have an associated species lists, then the following questions must be addressed and data management procedures adopted to answer the following:
- "How to share data so that we know that my species A is the same as someone else's species A, and how do we link these names?"
- "What is the correct taxonomic authorship for the name?"
- "What is the most recent /accepted spelling of the name?"
- "What is the taxonomic hierarchy for a name?"
- "How can we quality control the original identifications?"

In order to address these questions within DFO, first a list of data managers, programs, and scientists who are working with data collections that include taxonomic names must be compiled. Questions to ask would be: "How are the species lists associated with these data collections managed? How should we quality control these lists? Do all lists contain a link to a recognized standard code such as the Integrated Taxonomic Information System's code (the ITIS.TSN)? Have any common problems been encountered? Are regions familiar with and/or utilize registers of marine species?"

A Microsoft PowerPoint© presentation entitled "TEN BASIC POINTS" listed facts concerning species lists. Acknowledgement of these facts (listed on the next page) was essential in order to lay the groundwork for upcoming workshop discussions on the quality control of specimen identification and name assignment, the standardization of name spelling, and methods to exchange data.

Table 1. Summary of the "Ten Basic Points" slide presentation.

1	Biological collections will contain a list of names called a species list. Species lists may include: • Common names. • Scientific names without scientific name 'authority' or authorship. • Terms for non-living matter (plastic, stones…). • Groups of names. • Concatenated fields (life history stages, rank, modifiers…).
2	Lists of scientific names should include the authorship. If your current list does not include this information, then take the time to add and fill this new field. *If possible, include an additional field with reference information – publication and page number…*
3	Mapping or linking species lists, but names rarely agree. There are two options available to link names: • Could use a fuzzy matching program…, or • Could assign a standard code to scientific names (example ITIS.TSN).
4	Assignment of standard code enables linkage to master list (ITIS): • Standard spelling/format for scientific name and authorship. • Linkage between synonyms and valid name. • Taxonomic hierarchy.
5	ITIS is not complete – it does not contain all taxa. ITIS codes will not / cannot be assigned to all names. Examples: • Non taxonomic names. • Grouping of non taxonomic names. • Older invalid names. • Common names.
6	Assign negative standard codes for names not in ITIS.
7	Assignment of a standard code does not QC the identification.
8	Definition: A register of species is a <u>complete</u> list of <u>all</u> species found in a defined area.
9	If a species list name does not occur in the local register: • The original identification/name assignment needs verification, or • The register should be updated.
10	We have data from different oceans and we work on different groups. • Invasive species. • Freshwater and marine taxa. • Plankton, benthos. • Crustacean, fish, birds, mammals. We all have our own codes and wish to retain these codes.

REGIONAL REPORTS

Workshop participants were requested to present an overview of DFO biological collections and associated species lists used in their respective regions, and to discuss existing taxonomic problems encountered. Regional action items that were identified are tabulated in Appendix IV.

Newfoundland and Labrador (NL) Region Report

E. Murphy led a discussion about the level of taxonomic identification and its variability. The level of identification is directly related to the expertise of the person analyzing the samples and/or the amount of funding available. Not every data collection will be identified down to the lowest taxon possible.

When comparing datasets where the level of identification varied between samples, it might appear as if species were appearing and/or disappearing. Is this observation real? Or are identification problems due to new staff and/or changes in the sampling and analysis protocols the true reason? The extent of this problem is hard to gauge.

In NL, it has been standard procedure to identify specimens at sea whenever possible. In many cases, this identification is often performed by staff who have not had formal taxonomic training. In the past, selected sample specimens were frozen and brought back to the laboratory for identification confirmation; however, this protocol has fallen apart in recent years, leading to unidentified species being entered into the NL database.

The species lists used in science in NL are easily mapped to lists accessible on the Maritimes Virtual Data Centre (VDC). Two publications describe coding procedures used by the Northwest Atlantic Fisheries Centre (NWAFC) are listed in the table below:

Table 2. Abstracts from 2 Newfoundland and Labrador code table publications.

Reference	Abstract
Akenhead, S.A., and E.M. LeGrow. 1981. The vertebrates code of the Northwest Atlantic Fisheries Centre. Can. Data Rep. Fish. Aquat. Sci. 309.	Approximately 500 species of fish recorded by the Northwest Atlantic Fisheries Centre are assigned to higher taxa and given a unique, ordered, 3 digit numeric code. A checklist for the Newfoundland-Labrador region is indicated. The marine mammals of the Northwest Atlantic are included as a separate section.
Lilly, G.R. 1982. The marine invertebrates code of the Northwest Atlantic Fisheries Centre. Can. Data Rep. Fish. Aquat. Sci. 365.	In order to facilitate standardization of coding procedures at the Northwest Atlantic Fisheries Centre, unique 4-digit numerical codes were assigned to selected marine invertebrate taxa, which have been or might be recorded in field surveys and studies of groundfish stomach contents. The species list is not a checklist for the Newfoundland-Labrador marine region.

Maritimes (Mar) Region Report

M. Kennedy presented two examples of species lists used in the Maritimes. The first list was the taxonomic code table from the DFO national BioChem database (www.meds-sdmm.dfo-mpo.gc.ca/biochem/biochem_e.htm). The second species list was an older version of a code table used by the former Marine Fish Division for one of their databases.

The BioChem code table contained the following fields:
- Taxonomic name and Taxonomic authorship.
- BioChem database species code.
- Standard code (ITIS.TSN or negative code).
- Collectors_comment.
- Datamanagers_comment.

The older database code table contained the following fields:
- Common name.
- Taxonomic name.
- Database or research code.
- Commercial code.
- FAO species code.
- ICNAF species code.
- NMFS species code.

It is no longer necessary for individual species lists to contain codes for every conceivable species list that the user might wish to link to. However, they must contain the taxonomic authorship in addition to the taxonomic name, in order to map the record to the standard code. If each list contains this adopted standard code, then mapping will be facilitated and the individual species lists may contain fewer fields, since they will no longer be required to contain all the reference list individual code values.

Maritimes Region has developed a procedure to 'fuzzy' map names to the adopted standard code. These standard codes include the ITIS.TSN code, or if this value does not currently exist, a negative TSN code has been assigned (Kennedy and Bajona 2009). Once assigned, software routines utilize these standard codes to link to back to the ITIS database and to obtain a standardized spelling, link to the valid name, and extract the latest taxonomic tree information (Appendix V).

Table 3. Abstract from the Maritime technical report on taxonomic standards.

Reference	Abstract
Kennedy, M., and L. Bajona. 2009. A data manager's guide to marine taxonomic code lists. Can. Tech. Rep. Fish. Aquat. Sci. 2827.	A comprehensive taxonomic list is required to efficiently share and integrate biological data by organism names. Beyond the frequent human error introduction of mixed cases and typos, there is the common occurrence of multiple names for the same organism (synonyms) and the same name applied to many different organisms (homonyms). A given dataset may refer to an old name that has been updated by the taxonomic experts, and may also have a separate entry for the new currently accepted name. Users accessing the data may not be aware of the multiple names, thus, may only obtain a subset of the data they were looking for and likely need. Linking multiple datasets only increases the chances of missing relevant data. Sharing biological data over the web necessitates a decision on standardization of organism names. This report suggests methods to standardize taxonomic lists and to develop species registers 'o provide quality control.

One of the problems with biological data management is that often data managers in one region are not aware of initiatives that are taking place in other regions. One example of a related working group within DFO is the DFO Taxonomic Working Group. It was requested to have information on this working group circulated to the workshop participants.

Gulf Region Report

T. Hurlbut, the Gulf regional representative, was unable to attend the workshop – his flight was cancelled due to a snowstorm in Moncton, NB, on the day of departure. Hurlbut is a biologist in charge of the Gulf Region bottom-trawl survey database.

The following comments from Hurlbut were provided through a series of emails prior to the workshop.

"The choice of which species codes to use is an issue that affects our entire (Oceans and Science) branch. It is certainly a large issue for us with our annual, multi-species (formerly groundfish), bottom-trawl survey database (which I am responsible for). With this survey, we continue to use the same species codes as Maritimes Region, but we differ from Newfoundland and Québec regions."

"Data are being collected on species by Oceans staff (Community Aquatic Monitoring Program – 'CAMP' program) and all of the sections within the Aquatic Resources Division."

"The species codes used by Policy and Economics (statistics), which include ZIF (Zonal Interchange File Format - Commercial fishery landings data) and Northwest Atlantic Fisheries Organization (NAFO) data, are also somewhat different, but I understand that this workshop exercise is restricted to science data."

"Biorex Inc. fisheries observers use the same species codes that we use for our annual, multispecies, bottom-trawl surveys."

"With our annual, multi-species, bottom-trawl survey database, we use codes for fish, invertebrates, marine mammals (occasionally), marine plants and algae, the eggs of fish and invertebrates, and other ('miscellaneous') articles (e.g., Stones/rocks, mud, wood, man-made garbage/debris, oil, etc.)."

NOTE:
> "1. If we choose to go with ITIS codes, our suggestion would be to add a field with the ITIS species codes to our data files instead of replacing the 'old/existing' codes. Removing the old codes would mean quite a lot in terms of re-coding our analysis programs and our survey data capture program.
>
> 2. We (Gulf Oceans and Science Branch) do not keep our data in Oracle databases and we do not use the VDC (we still work with ASCII files)."

Quebec (Que) Region Report

L. Devine reported that zooplankton and phytoplankton data collections from Institut Maurice Lamontagne (IML) are archived in BioChem and use the BioChem taxonomic code tables.

Another database at IML includes fisheries data and uses a distinct species code standard. Several different species coding systems are used in the different programs supplying data to this database: research surveys use the STRAP codes (STRAP: stratified random analysis program [this is the same code system used in Newfoundland for fisheries data]); the commercial sampling and at-sea observer programs use the RVAN codes, which are also used in the Maritimes for fisheries data. The survey database includes a table that cross-references these species codes. It would be possible to add the ITIS codes to this cross-referencing table.

National Capital (NCR) Report

ISDB/MEDS maintains a copy of the ITIS database on their Oracle server in Ottawa. Access to this copy of the ITIS database will greatly facilitate development of many procedures within DFO. However, it is essential that this copy of the database is refreshed frequently and on a routine basis. M. Kennedy spoke briefly with C. Guay, the database administrator for these DFO 'ITIS' tables, and his comments are listed below:

"ISDB/MEDS updates this database 1-2 times per year. This is a major ordeal and involves the following steps:

- Break links between the ISDB.ITIS dbase and associated databases
  - AIS (Aquatic Invasive Species).
  - NAAHP (National Aquatic Animal Health Program).
  - Other read-only links (ELA's, POST (Pacific Ocean Shelf Tracking).
  - *Note - There isn't a direct link between MEDS.ITIS and BioChem.*
- Delete the ISDM copy of the ITIS database.
- Download the most recent copy of the ITIS database following the ITIS instructions (http://www.itis.gov/ftp_download.html) for a full database download.
- Load the data into the ISDM ITIS relational database.
- Fix all database structure differences if any then reload the data.
- Find all relational problems within the database and refer to the ITIS folks for fixes if any.
- Recreate the links to the associated databases and other Oracle accounts.
- Re-enable constraints in various Oracle accounts.
- Validate in each BioChem/AIS/NAAHP accounts that the species name used is still the active one and fix accordingly.
- Length of time commitment to perform update can vary from a few days to a week each time depending on problems encountered and time required by ITIS to provide a solution."

Central and Arctic (C&A) Region Report

During a visit to Winnipeg, MB, the week before the workshop, M. Kennedy met with a number of biologists and data managers and was given a general overview of a few of the biological datasets maintained at the Freshwater Institute (FWI) by S. Kaisian and D. Guss.

D. Guss gave a brief overview of an access database being used for data entry for C. Podemski (Zoobenthic Ecologist). This database, which contains data from the experimental lakes area (ELA), is connected to the MEDS copy of the ITIS tables.

M. Stainton and H. Kling discussed their phytoplankton species list from Lake Winnipeg and the ELA region. More information on their work was contained in a proposal submitted to NSDMC: see extract on next page. This project was not funded at that time.

NSDMC proposal 2007-08
DESCRIPTION: From 1969 to 1996, Hedy Kling was an algal taxonomist employed by DFO to provide microscopic analysis and interpretation of the algal community present in a wide variety of aquatic ecosystems under study by DFO scientists. During this period, Ms. Kling gained an international reputation for her expertise in the analysis and interpretation of the relationship between algal morphology, community structure, and population dynamics in lakes and various physical and chemical stressors. Her data/sample set includes samplings from all of Canada's great lakes (Laurentian and otherwise with a long data record from Lake Winnipeg and Lake of the Woods), all of the African Great Lakes (extensive records from Lakes Victoria and Tanganyka and Malawi), the great lakes of Europe, and more recently from lakes from south America. There is also a data/sample set from a variety of hydro electric reservoirs reflecting the impact of impoundment. Ms. Kling's data/sample set also includes microfossil remains from several thousand samples of dated core slices from lakes from around the world many of which capture the record of human impact on broad variety of aquatic ecosystems.

Scientists at the FWI are involved in International Polar Year (IPY) projects. C. Sawatzky provided a copy of a recent IPY report that included their fish species list.

Pacific (Pac) Region Report

Two groups of participants from the Pacific Region attended the workshop. The first group was from the Institute of Ocean Science (IOS) located in Sidney, BC. The second group was from the Pacific Biological Station (PBS) in Nanaimo, BC. Data collections from these 2 institutes covered 2 completely different groups of organisms. The data collections from IOS were planktonic in nature, while those from PBS covered larger invertebrates and fish.

The IOS Pacific Region Zooplankton Database (http://www.pac.dfo-mpo.gc.ca/sci/osap/projects/plankton/zooplanktondatabase_e.htm) has been in existence for approximately 15 years. This database contains data collections from a multitude of west coast areas including:
- Strait of Georgia,
- West Vancouver Island,
- North coast British Columbia,
- Queen Charlotte Islands,
- Gulf of Alaska,
- continental Pacific, and
- line P.

The species code table for this database includes a field for the taxonomic authorship, as well as the ITIS.TSN code. When a new name is to be appended to the species list, the procedure is to obtain the taxonomic authorship from the ITIS database and then contact a local taxonomist/expert to confirm this assignment.

The majority of data collections archived in the IOS Zooplankton Database will eventually flow into the DFO national archive, BioChem. With this in mind, in October 2007, the database species list was mapped to the BioChem national taxonomic code table.

Moira Galbraith discussed the procedure that she follows when she, a taxonomist, identifies a new specimen in one of their zooplankton samples. The procedure is to assign a museum id to the new taxon and then to send specimens with associated metadata, such as who assisted with the identification, date, location, depth, etc., to the following locations:

- National Museum.
- Smithsonian.
- BC museum.
- Expert for species.

G. Gillespie led the PBS species list discussion with contributions from K. Rutherford and G. Jorgensen.

Initial discussion focused on the various species code lists used in the Pacific Region, plus various regional and international taxoncmic initiatives.

The fish and invertebrate species codes in Pacific Region are managed by G. Jorgensen. L. Biagini at Head Office in Vancouver, BC, helps to maintain the tables for species aggregates.

The species codes are usually based on the pages corresponding to each species in Hart's '"Pacific Fishes of Canada". These codes are collectively referred to as the "Hart codes". Two references for these codes are listed below along with the abstract for these books.

Table 4. Abstracts from 2 Pacific Region code table publications.

Reference	Abstract
Hart, J.L. 1973. Pacific fishes of Canada. FRB Can. Bull. 180.	Updates the 1961 edition of "Fishes of the Pacific Coast of Canada". Contains descriptions, life history, distribution, place, economy, utilization, and references for each species of fish found in salt water off the Canadian coast. Analytical keys for all species are provided, and stipple drawings.
Gillespie, G.E. 1993. Can. Tech. Rep. Fish. Aquat. Sci. 1918.	The author has updated and corrected a previous list. Many species have been recorded from British Columbia waters for the first time, and numerous taxonomic changes have taken place, since the construction of the list. This manuscript provides documentation of the changes which have occurred, and assigns 3 digit-codes to all species and to other useful taxonomic units, for use in databases at the Pacific Biological Station.

The current PBS species list contains codes for fish and invertebrates, as well as common marine mammals and birds (with common algae to be added soon). This list does not contain scientific authorship information. This information could easily be added for the fish – (just requires funding).

Mention was made of the Strait of Georgia Initiative and the existence of a 1985 check list of species for the area compiled by Dr. Bill Austin.

Comments were made, similar to those previously noted during the NL regional report, which were related to the trend of increasing species diversity in data collections with the hiring of new staff and the converse - 'diversity' crashes with the retirement of 'experts'.

It was also noted that various groups are using images as references during the specimen identification process.

This basically completed the regional report on Pacific Region code lists and identification procedures, and the discussions switched to the topic of taxonomic initiatives in the Pacific Region. The initiatives listed below will not be described in this document:
- North Pacific Marine Science Organization (PICES), aquatic invasive species (AIS) and ballast water.

- Marine Ecoregions of the World (MEOW).
- ICES Introductions and Transfers Group.

Discussion then focused on the potential creation of registers of marine species for the West Coast area. What areas should be chosen?
- Geographical?
- Biological?
- Oceanographic?
- US/Canada boundary?

Potential areas of interest are listed below:
- 200 mile limit.
- Long term Pacific monitoring locations, e.g., Station P (Ocean Station Papa - www.oceansites.org/network/pacific/PAPA_Jan05.doc).
- North Atlantic Fisheries Organization areas (e.g., NAFO #67).
- Large Marine Ecosystems (LME).
- (MEOW) – (PICES) invasive species region (Marine Ecosystems of the World).

This completed the DFO regional representatives' reports. Next L. Bajona made a presentation on behalf of OBIS Canada.

OBIS Canada Report

OBIS stands for the Ocean Biogeographic Information System (www.iobis.org) and is the marine component of the Global Biodiversity Information Facility (GBIF) (www.gbif.org). Canada provides data to OBIS through its regional OBIS node, or RON, which is located at the Bedford Institute of Oceanography (BIO) in Dartmouth, NS.

Currently, OBIS Canada (www.marinebiodiversity.ca/OBISCanada) manages 17 collections/ datasets:
- Atlantic Canada Conservation Data Centre.
- Atlantic Reference Centre.
- Bay of Fundy Species Information System.
- Canadian Maritime Regional Cetacean Sightings.
- Canadian Museum of Nature.
- Davis Strait and Baffin Bay zooplankton.
- DFO Maritimes Research Vessel Trawl Surveys Fish Observations.
- Eastern Benthic Macrofauna.
- East Coast North America Strategic Assessment.
- Electronic Atlas of Ichthyoplankton on the Scotian Shelf of North America.
- Grand Manan Basin Benthos.
- Gwaii Haanas Invertebrates.
- Gwaii Haanas Marine Plants.
- Marine Invertebrates Diversity Initiative.
- Nova Scotia Museum of Natural History.
- Pacific Ocean Shelf Tracking.
- Resolute Passage Copepod Distribution.

Because OBIS's focus is biodiversity, it naturally contains taxonomic information. OBIS Canada is developing procedures to update the OBIS taxonomic hierarchy fields with ITIS content.

The current OBIS schema supports presence/absence information (as opposed to abundance or biomass information).

Each data collection sent to OBIS must have an associated metadata page (GCMD OBIS Canada Node http://gcmd.nasa.gov/KeywordSearch/Freetext.do?KeywordPath=&Portal= caobis &MetadataType=0&Freetext=DIF/IDN_Node%3A+OBIS/CA) describing the temporal, spatial, and taxonomic coverage of the collection. This information will facilitate 'discovery' of the collection on this portal. Metadata sheets are being updated with improved/standardized information related to whom to contact for further information about the collection.

OBIS Canada is linked to the Centre for Marine Biodiversity (CMB). The CMB (www.marinebiodiversity.ca) supports various biodiversity initiatives such as:
- The Gulf of Maine Census of Marine Life (GoM CoML).
- The Bay of Fundy Information System.
- The Discovery Corridor Project.

DISCUSSIONS
How do we standardize, QC, and share our species lists?

Procedures outlined in the technical document written by Kennedy and Bajona were discussed. The basic premise in this document is that all species lists should have their names mapped to a standard, and that names in a list can be quality controlled through comparison with local registers of species.

Standardization

All participants agreed that it is easier to link one species list to another, if both lists contain a standard code. The other option is to attempt to match names and authorships directly. This routine would involve decision making if the matches were fuzzy, i.e., often names in different lists contain slight spelling variations.

Participants agreed to adopt the ITIS.TSN code as the DFO standard code, and if a name from a species list was not in ITIS, then the procedure of assigning a negative TSN to the name as outlined in the draft document would be followed.

A brief discussion was held concerning the technical issue of how data managers should map names to the ITIS codes. If there are only a few names that require code assignment, then searching the ITIS web site and manually assigning the code is an option. If there are hundreds of names that require code assignment, then this can be tedious.

DFO Maritimes maintains a materialized view of the ITIS Oracle tables stored at ISDM in Ottawa. Routines have been written in PL/SQL to match names from a given list with those in ITIS tables and to extract the name's ITIS.TSN.

DFO Maritimes are in the process of revising routines that if given a name and a TSN, then the ITIS database will be searched and the following information will be returned:
- The given name's validity.
- The correct spelling for the given name.
- The accepted synonym for the given name.
- The taxonomic hierarchy for the accepted name.

One of the stumbling blocks outlined in the technical document with using ITIS as the standard exchange code is that many names in our species lists are not contained in the ITIS database.

The group discussed current contact with ITIS when an uncoded name is encountered. Typically, the approach is to send ITIS a list of taxonomic names and authorships, along with the reference material used to make the taxonomic identification. This method does not work – it could take a very long time for short lists of names to be appended to ITIS.

It is not a normal procedure for ITIS data managers to simply add a new species name to their database. If given a new name, then ITIS acknowledged taxonomic experts are requested to review the name. These experts must confirm that this new name is not a synonym for a name already in the database, etc. Therefore, new names are generally accumulated and priority for review is given to groups with multiple requests.

The following question was raised: "How can DFO collaborate with ITIS in order to speed up the process of appending new marine species?" It was suggested that direct contact with ITIS data managers be limited to designated DFO representatives. If regional data collections require names to be added, these names should be first sent to a regional DFO-ITIS representative and then this representative would initiate contact with ITIS and commence submission of names from their region on a routine basis in a standard format.

It was proposed that a DFO-ITIS workshop be held to:
  a) Teach DFO data managers how to make submissions to ITIS.
  b) Inform ITIS about our data collections and our requirements.
  c) Discuss with ITIS what qualifications they require in order to designate a Canadian taxonomist as one of their accepted experts. Perhaps Canadian taxonomists can assist with the taxonomic review process for new names.

Quality Control of Species Lists

Biological data sets historically were the property of an individual scientist/program and were collected for specified purposes. With the advent of large archives and the need to share and exchange data, many legacy data collections are being recovered and appended to standardized monitoring data collections. The result is that the database may now contain species names that were assigned by analysts with a wide range of taxonomic expertise. There are no perfect methods to handle this problem other than to recommend that sufficient metadata about the collection sampling and analysis methods be archived, along with the biological data.

One method to quality control a species list proposed in the technical document is to run a comparison between the dataset species list and the local register of marine species. If a name in the species list does not occur in the register, then flags should be raised and proposed procedures should be followed (Kennedy and Bajona 2009).

A discussion was held describing what registers currently exist and could be utilized by DFO data managers. These registers include the following:
  • BoFRMS and GoMRMS created/maintained by the Atlantic Reference Centre.
  • NWARMS created/maintained by the Atlantic Reference Centre.
  • CanARMS created/maintained by the Atlantic Reference Centre.
  • NARMS derived from MarBEF is maintained by VLIZ.
  • WoRMS created/maintained by www.marinespecies.org.

International Taxonomic Programs

The last part of the workshop involved discussions of related international taxonomic programs. M. Kennedy provided a diagram showing the relationships between these various programs. DFO's new CanRMS would feed into WoRMS as a regional species list, and, therefore, contribute to the Catalogue of Life.

Figure 1. Diagram redrawn from IODE-GEBICH meeting proceedings (Oostende, Belgium; November 2006).

Brief descriptions of the various programs drawn in Figure 1 were presented using the information displayed on the individual program web pages. The URLs for these web pages are listed below in Table 5.

Table 5. List of web page addresses for international taxonomic programs.

Program Name	Home Page URL
GBIF	http://www.gbif.org/about_gbif
OBIS	http://www.iobis.org/about/
Catalogue of Life	http://www.catalogueoflife.org/info_about_col.php
World Register of Maine Species	http://www.marinespecies.org/about.php
European Register of Marine Species	http://www.marbef.org/data/erms.php
Species 2000	http://www.sp2000.org/index.php
ITIS	http://www.itis.gov/about_itis.html
Fishbase	http://www.fishbase.org/home.htm
Algaebase	http://www.algaebase.org/
Genbank	http://www.ncbi.nlm.nih.gov/Genbank/

Canadian Register of Maine Species – CanRMS

One of the objectives of this workshop was to design database tables to house Canadian registers of species. These tables will be archived in an Oracle database housed at the Bedford Institute of Oceanography, Dartmouth, NS. Talks are underway for DFO Maritimes to obtain copies of the latest versions of the Atlantic Reference Centre's (ARC's) registers. These register

records will be loaded into the new CanRMS. The ARC will be cited as the original source for records in the registers.

New registers should be created for the Pacific, Arctic, and Lake Winnipeg. The initial source of names for these registers will be compilations of verified local species lists.

Prior to designing CanRMS various definitions had to be declared and information to be contained in the register had to be agreed upon.

Definition #1: DFO biological data collections usually contain an associated **species list**. This list may contain the following:
- Common names.
- Scientific names with authorities.
- Scientific names without authorities.
- Variety of taxonomic ranks.
- Non-living terms.

Definition #2: A **register of species** is a comprehensive list of all species names within a given area.
- The 'master' register for the world is WoRMS[1].
- Local registers will have a parent register and may or may not have a child register. Example: WoRMS is a parent for NARMS and NWARMS is a child of NARMS (where Wo=world; NA= North Atlantic and NWA= Northwest Atlantic).
- The given area for a register should be defined and included in the Oracle Areas table. The area coordinates should define a 'polygon' and not a simple box.
- The scientific name of an individual identified down to the species level is comprised of two units – the genus name and the species name. In the following, when we refer to the **species name,** we will imply genus + species.

Species Registers - Database Design

Register Database Content – What information should be stored?
- Can be just a simple list of names.
- References to synonym names may be included.
- A list of reference material used to identify the 'name' may be available.
- A reference note related to the source of the name may be included:
  - museum collections, museum vouchers, books, internet documents and collection databases.
- Information on the geographical coverage of the species.
- Must contain a reference to the parent register.

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[1] WoRMS, the World Register of Marine Species the OBIS community is developing; was accepted by Species 2000 as its marine node. Many of the Global Species Databases (GSDs) now maintained within the WoRMS system will automatically be contributed to Catalogue of Life. Catalogue of Life is a collaborative venture between Species 2000 and ITIS, and is regarded by many as the prime supplier of information on taxonomy. Discussions on how to organise this were held in Auckland, New Zealand, from 7 to 9 November 2007 (*taken from OBIS web site*).

o   Each local register will be a child of a larger register. Example, the Bay of Fundy is a child of the Gulf of Maine, which is a child of the Northwest Atlantic, which is a child of the North Atlantic, which is a child of WoRMS.

o   If a species name is appended to a register or modified, then this information should be 'pushed' up to the parent.

Table 6. Draft design for CanRMS database tables. PK indicates potential primary key and FK indicates potential foreign key.

Table Name	Field Name	Description/Examples
General Information	Register Name	PK
	Polygon_id	FK to polygon Table
	Realm	Freshwater or marine
	Range of inclusivity	Animal kingdom only; Everything except bacteria...
	Parent register name	
Bounding Area Polygon	Bounding Area Polygon name	
	Polygon_id	PK
	Ordinal number	
	Latitude/longitude coordinates	
Register of Species	Register_name	FK to General Info
	RegisterSpecies_id	PK
	Scientific name	
	Authority	Kingdom specific - (name and year)
	ITIS.TSN	
	Negative TSN	
	Verified	Yes/no
	Taxonomic Expert Name	Who performed the verification/ update; FK
	When was Last Update	
	Which DM performed the update	Data manager's name
	Taxonomic Expert Comments	
	Data Manager Comments	
	Child Register Reference	Original Source of Name ARC reference; 'child register' name
Reference Table(s)	RegisterSpecies_id	FK to register of species record
	Official book reference	Standard format as for tech reports
	Page number	
Negative TSN Table	See attached documentation	
Taxonomic Experts	Taxonomic Expert Name	PK
	Contact info	
	comments	Specialist in what taxonomic groups

The mandate for the register is solely as a list of names. Additional tables may be created to house 'extra' information such as life history, etc.

Species Register - Technical Issues

Table design:
- Maritimes Region to create draft Oracle Tables.
    - Who can create tables on this site?
    - Who can alter the table design?

Access issues:
- Should data managers have direct access to the database for ad hoc queries?
- Should the registers be made accessible through the Virtual Data Centre?
- Can data managers access the database through ODBC links?
- Can the Centre for Marine Biodiversity (Dalhousie University) provide a brief introduction and link to the registers for outside users on one of their web pages?

Grant permission:
- Read/write to data managers (regional appointed contacts).
- Read only to selected data managers.

Create "Technical Committee for Canadian Registers of Species":
- All workshop participants?
- Technical committee mandate:
    - Maintain database.
    - Support/promote capacity building.
    - Provide access to lists to other groups – CWS, EC, provincial, universities, etc.
    - Collaborate with international programs such as WoRMS.

Create standardized register of species names:
- "xxxxRMS":
    - NWARMS
    - BoFRMS
    - GoMRMS
    - ERMS
    - WoRMS
    - *CPacRMS - Pacific Canadian territorial waters*
    - *NEPacRMS - NE Pacific*
    - *CARMS – Canadian Arctic*
    - *GSLRMS – Gulf of St Lawrence*
    - *LWRFWS – Lake Winnipeg (fresh water species)*

Create and/or refine bounding areas for individual Registers.
Suggest that WoRMS promote a standardized committee structure, terms of reference, and citation for local registers.

Commence capacity building in the Pacific Region:
- IOS – Phytoplankton and Zooplankton Database Species list 50u (Arctic), 236u to 1050.
- PBS - Marine mammals; Commercial Invertebrates; Fish.
- CWS – Birds.
- Queen Charlotte Islands, Parks Canada Gwaii Haanas - marine inverts, plants, birds.

Species Registers – Capacity Building

Step 1 – Append authority information to existing species lists. If available, append the reference book information.

Step 2 – Append existing lists by taxonomic group.
- Names on existing lists to be appended if they have been verified by literature - if not verified, do not add.
- If name questionable (rare occurrence), then consult local expert or the Board of Editors
      and/or
- Extract list of names from local databases using the register bounding area definitions to determine if any new names. Verify and append,
      and/or
- Append 'unverified' names but do not release to the public.

Clarification of terms - What is the difference between confirmed and verified?
- **'Confirmed'** in register means that this name has been recorded in the literature as occurring in this region and/or a voucher exists from a sample caught in this region.
- **'Verified'** in ITIS means that the ITIS taxonomists are happy. The name could be valid or not.

Implementation

- The local registers, i.e., the Oracle names tables, could be archived on an Oracle server at BIO.
- The VDC could provide access to the Oracle tables to the ARC and DFO data managers.
- The taxonomic standards working group would recommend to the NSDMC that continued annual support should be provided to the maintenance of Canadian local registers. List of priorities to be discussed and assigned:
    - Support for OBIS Canada and Maritimes coding procedures.
        - Initial mapping of names to ITIS.
        - Periodic review of ITIS coding.
        - Maintenance of Negative table.
    - Support for the review of existing entries.
    - Creation of and support for Register Board of Editors, i.e., taxonomic expertise.
        - The ARC.
        - Other taxonomic experts.
    - Support for CMB
        - Host 'Intro to Registers' page with links to various URLs.
        - Host documentation related to taxonomic standards.
        - *Technical support for information system(s) maintenance.*
- Periodic review of the ITIS codes could be performed through collaboration with OBIS Canada.
    - Potential collaboration with T. Rees and adoption of 'fuzzy matching' procedures IRMNGR (International register of marine and non-marine genus records) presented at the OBI'07 Conference.
    - ITIS.TSN values to be assigned programmatically – routines match scientific name and authority in list with records in the ITIS database.
        - If the names/authorities are slight variations, then the ITIS spelling will be adopted.

- If the names/authorities are different, then a taxonomic expert will be consulted.
- If the authorities are missing, then perhaps a negative code should be assigned.
- If the name is not in ITIS, then a negative code will be assigned.
- Negative code table maintenance.
  - Common names.
  - Non taxonomic names.
  - Names not in ITIS.
    - Prepare records for submission to ITIS.
- Information Systems are beyond the scope of this standards group however it should be noted that products such as the Bay of Fundy Information System (http://www.marinebiodiversity.ca/BayOfFundy/background.html) could be provided by the CMB (maintenance of this system would be the responsibility of the ARC or other interested groups and the CMB).

Collaboration Between Registers

If a change is made to child register, then how should changes be pushed up to parent>>grandparent>>great-grandparents>>registers?

Example, a new species is added to the Bay of Fundy register after verification by local experts.
- This should trigger an append notification to be sent to the BoF parent register, NWARMS data manager.
- Next the NWARMS Board of Editors would review the request.
  - If the request was denied then the child register data manager would be contacted and consultation would then involve additional local taxonomists...
                                        -or-
  - If the request was accepted, then the record would be appended and the NWARMS parent register NARMS would be contacted and their Board of Editors would review the request...
                                        -or-
  - If the request was accepted, then the record would be appended and the NWARMS parent register WoRMS would be contacted and their Board of Editors would review the request...
    - Should Canada feed North Atlantic or the world?
    - WoRMS could feed NARMS.
    - Reciprocal agreement with WoRMS if any records in their list fall within Canadian defined register areas.
      - Who would be the liaison with WoRMS?
      - This liaison would have to be in contact with all local data manager, in order to coordinate local registers with WoRMS records.

APPENDIX I. LIST OF PARTICIPANTS

Name	DFO Region-Institute	Brief Profile* (What geographical area does their work cover? What taxonomic groups do they work with? What is needed in their field? Basic personal background: biologist, taxonomist, data manager, computer programmer? Favorite buzz words, acronyms...)
Eugene Murphy	NL-NAFC	Computer scientist and data management. Fish and shrimp from NW Atlantic (St. Pierre to Baffin Bay area).
Mary Kennedy	Mar-BIO	Biologist and data management. - Plankton data collections from Atlantic, Arctic, and eastern tropical Pacific. - National archive BioChem. - BioChem data manager in charge of the taxonomic code table. - OBIS Canada. - AZMP Maritimes. - CMB Tech committee. - IODE Group of Experts on biological and chemical data management and exchange practices (GE-BICH).
Lenore Bajona	Mar-BIO	Programming and data management. - OBIS Canada. - CMB Technical committee. - VDC-BIO.
Tom Hurlbut	Gulf	Biologist working primarily with groundfish.
Laure Devine	Que-IML	Biologist and data management. - Data collections from the Gulf of St Lawrence, Hudson Bay, and Strait areas. - National archive BioChem and OSL. - AZMP- Que (ctd and bottle data).
Steve Romaine	Pac-IOS	Biologist and data management. - Data collections from North Pacific, Arctic, Antarctic. - National archive BioChem and Pacific zooplankton database. - OBIS Canada.
Moira Galbraith	Pac-IOS	Taxonomist - Maintains regional list of west coast and Arctic zooplankton (from California/Oregon to the Gulf of Alaska). - Pacific zooplankton database.
Deborah Faust	Pac-IOS	Data management. - Pacific zooplankton database. - Soon to take over BioChem responsibilities from S. Romaine.

Name	DFO Region-Institute	Brief Profile* *(What geographical area does their work cover? What taxonomic groups do they work with? What is needed in their field? Basic personal background: biologist, taxonomist, data manager, computer programmer? Favorite buzz words, acronyms...)*
Georg Jorgensen	Pac-PBS	Programming and data management. • Shellfish database. • Manages species codes and associated tables.
Kate Rutherford	Pac-PBS	Biologist and data management. • Pacific groundfish and invertebrates. • California to Alaska.
Graham Gillespie	Pac-PBS	Biologist and taxonomist. • Pacific groundfish and invertebrates. • Aquatic invasive species database.
Laure Biagini	Pac-Head Office	Catch statistics for commercial finfish.

APPENDIX II. WORKSHOP AGENDA

Wednesday January 16th

08:00   Welcome, Introduction, and Agenda review
09.00   Current Status of DFO Taxonomic Lists and Regional Comments
            NL, Mar, Gulf, Que, NCR, C&A, Pac
12:30   Lunch
13:15   Standard Codes, QC, and Sharing of species lists
                        •   ITIS
                        •   Registers
                        •   International Programs
14:15   Maritimes model for Canadian species registers
                        •   Design

Thursday January 17th

08:00   Canadian species registers
                        •   Areas
                              •   Atlantic & Pacific.
                              •   *Arctic?*
                              •   *Gulf of St Lawrence?*
                              •   *Experimental Lakes Area (ELA)?*
                        •   Taxonomic coverage
                              •   All taxonomic kingdoms (i.e. everything)
                              •   phytoplankton only
                              •   crustaceans only
                        •   Roles and responsibilities
11:00   Other
12:30   Lunch
13:15   General Discussion and Summary

APPENDIX III. ACRONYMNS

Acronym	Description	URL (if available)
AIS	Aquatic Invasive Species	http://www.dfo-mpo.gc.ca/science/environmental-environnement/invasive_e.htm
ARC	Atlantic Reference Centre, St. Andrews, NB	http://www.huntsmanmarine.ca/arc.shtml
AZMP	Atlantic Zone Monitoring Program	http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/index-eng.html
BIO	Bedford Institute of Oceanography, Dartmouth, NS	http://www.bio.gc.ca/Welcome-e.html
BoFRMS	Bay of Fundy Register of Marine Species (Bay of Fundy Species Information)	http://www.marinebiodiversity.ca/BayOfFundy/
CAMP	Community Aquatic Monitoring Program	http://www.glf.dfo-mpo.gc.ca/os/camp-pcsa/index-e.php
CanRMS	Canadian Register of Marine Species	
CMB	Centre for Marine Biodiversity	http://www.marinebiodiversity.ca/
CSAS	Canadian Science Advisory Secretariat	http://www.dfo-mpo.gc.ca/csas/
CWS	Canadian Wildlife Service	http://www.cws-scf.ec.gc.ca/
DFO	Department of Fisheries and Oceans	http://www.dfo-mpo.gc.ca/index-eng.htm
EC	Environment Canada	http://www.ec.gc.ca/
ELA	Experimental Lakes Area	http://www.dfo-mpo.gc.ca/regions/central/science/enviro/ela-rle_e.htm
ERMS	European Register of Marine Species	http://www.marbef.org/data/erms.php
FAO	The Food and Agriculture Organization of the United Nations	http://www.fao.org/about/about-fao/en/
FWI	Freshwater Institute, Winnipeg, Manitoba	http://www.dfo-mpo.gc.ca/regions/CENTRAL/pub/fresh-douces/01_e.htm
GCMD	NASA's Global Change Master Directory	http://gcmd.nasa.gov/Aboutus/index.html
GBIF	Global Biodiversity Information Facility	http://www.gbif.org/about_gbif
GoMRMS	Gulf of Maine Register of Marine Species	
GSD	Global Species databases	
ICES	International Council for the Exploration of the Sea	http://www.ices.dk/aboutus/aboutus.asp
ICNAF	International Commission for the Northwest Atlantic Fisheries	
IML	L'Institut Maurice-Lamontagne, Mont-Joli, Que	http://www.qc.dfo-mpo.gc.ca/iml/en/gen/qui.htm
ISDB	Integrated Science Data Management	http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/index-eng.html
ITIS	Integrated Taxonomic Information System	http://www.itis.gov/about_itis.html
IOS	Institute of Ocean Science, Sidney, BC	http://www.pac.dfo-mpo.gc.ca/sci/sci/facilities/ios_e.htm
IPY	International Polar Year	http://www.ipy.org/index.php?/ipy/about/
LME	Large Marine Ecosystems	http://www.lme.noaa.gov/Portal/

Acronym	Description	URL (if available)
MarBEF	Marine Biodiversity and Ecosystem Functioning EU Network of Excellence	http://www.marbef.org/
MEDS	Marine Environmental Data Centre	http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/index-eng.html
MEOW	Marine Ecoregions of the World	http://www.worldwildlife.org/science/ecoregions/marine/item1266.html
NAFC	North Atlantic Fisheries Centre, St. John's, Nfld	
NAFO	Northwest Atlantic Fisheries Organization	http://www.nafo.int/about/frames/about.html
NARMS	North Atlantic Register of Marine Species	http://www.vliz.be/Vmdcdata/narms/
NCR	National Capital Region (Ottawa)	
NMFS	NOAA's National Marine Fisheries Service	http://www.nmfs.noaa.gov/
NSDMC	DFO National Science Data Management Committee	http://intra.dfo-mpo.gc.ca/science/nsdmc/index_e.htm
NWARMS	Northwest Atlantic Register of Marine Species	
OBIS	Ocean Biogeographic Information System	http://www.iobis.org/about/
OSL	Observatoire du Saint-Laurent	http://www.osl.gc.ca/en/index.html
PBS	Pacific Biological Station, Nanaimo, BC	http://www.pac.dfo-mpo.gc.ca/sci/pbs/about/default_e.htm
PED	Population Ecology Division, BIO	
PICES	North Pacific Marine Science Organization	http://www.pices.int/about/default.aspx
RMS	Register of Marine Species	
RON	Regional OBIS node	http://iobis.org/obisrons/randr/
RVAN		
SABS	St. Andrews Biological Station, St. Andrews, NB	http://www.mar.dfo-mpo.gc.ca/sabs/
STRAP	Stratified Random Analysis Program	
VDC	PED Virtual Data Centre	http://marvdc.bio.dfo.ca/
VLIZ	Flanders Marine Institute, Oostende, Belgium	http://www.vliz.be/vmdcdata/wlist.php?ThemID=12
WoRMS	World Register of Marine Species	http://www.marinespecies.org/
ZIF	Zonal Interchange File Format, Commercial Fishery Landings Data	

APPENDIX IV. WORKSHOP ACTION ITEMS AND RECOMMENDATIONS

Background
Circulate the report from the National Taxonomists Working Group.
Species Lists
Review the various groundfish code tables and if possible insert an additional column for taxonomic name authorship.
Confirm that the reference books of Scott and Scott and/or Liem and Scott can be used to update missing taxonomic authorship for NL fish lists.
Compile list of fish species code tables used on the Maritimes. Confirm that the Maritimes groundfish database is using SABS (Don Clark) species list.
What species lists do Maritimes fishery observers use?
What species lists are being used by the Gulf region's CAMP dataset?
Obtain copies of various species lists from FWI.
PBS to add authorship column to their species list tables.
Polygons and Bounding Boxes: Area Definitions for Registers
Define polygons for species register areas:
• Obtain area definition for the Pacific monitoring station P.
• PBS to define coordinates for areas of interest.
• Obtain area definition for Lake Winnipeg.
• Define the ARC register areas (Bay of Fundy, Gulf of Maine, etc.).
ITIS and Taxonomic Standards
Continue collaboration with Guy Baillergeron at ITIS Canada.
Review the process currently used by ISDM to update the ITIS tables. Discuss frequency of this update.
Organize a DFO-ITIS workshop to train participants, so that the process of name appending can be improved.
Kennedy and Bajona to publish their report – "A data managers guide taxonomic standards."
OBIS Canada to maintain a negative code table and this table to be accessible to other data managers.
Registers of Marine Species – Design, Capacity Building, and Maintenance
Design a database structure for Canadian local registers of species.
Obtain copies of the latest versions of the Atlantic Reference Centre's (ARC's) registers.
Populate registers for the Atlantic and Pacific regions.
Assign responsibilities related to maintenance and support of local and national registers.
Request continued support and funding for taxonomic standards.
Document workshop proceedings so that they can be referenced.

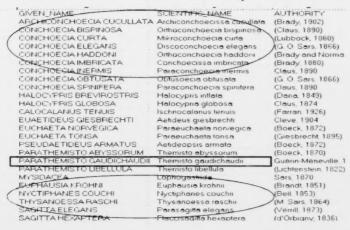## APPENDIX V. MARITIMES SOFTWARE DEVELOPMENT

Extraction of Information from ITIS

DFO Maritimes is working with OBIS Canada to develop procedures that will map species lists to a master list of names. At the moment, this standard list is ITIS and our lists include the ITIS.TSN code value.

By linking the species list TSN value to the ITIS tables, it is possible to get 'enriched' metadata:
- Can extract a standardized spelling. Example: *Nyctiphanes couchii.*
- Can extract the valid name. Example: *Conchoecia curta.*
- Beware...ITIS needs a little tweaking. Example: *Parathemisto gaudichaudii* was split, as well as having its name changed, so the mapping is not automatic – any changes in the name of a critter should be reviewed by a local expert.

Halifax Line "Enriched" Species List

GIVEN_NAME	SCIENTIFIC_NAME	AUTHORITY
ARCHICONCHOECIA CUCULLATA	Archiconchoecissa cucullata	(Brady, 1902)
CONCHOECIA BISPINOSA	Orthoconchoecia bispinosa	(Claus, 1890)
CONCHOECIA CURTA	Mikroconchoecia curta	(Lubbock, 1860)
CONCHOECIA ELEGANS	Discoconchoecia elegans	(G. O. Sars, 1866)
CONCHOECIA HADDONI	Orthoconchoecia haddoni	(Brady and Norman
CONCHOECIA IMBRICATA	Conchoecissa imbricata	(Brady, 1880)
CONCHOECIA INERMIS	Paraconchoecia inermis	Claus, 1890
CONCHOECIA OBTUSATA	Obtusoecia obtusata	(G. O. Sars, 1866)
CONCHOECIA SPINIFERA	Paraconchoecia spinifera	Claus, 1890
HALOCYPRIS BREVIROSTRIS	Halocypris inflata	(Dana, 1849)
HALOCYPRIS GLOBOSA	Halocypria globosa	Claus, 1874
CALOCALANUS TENUIS	Ischnocalanus tenuis	(Farran, 1926)
EUAETIDEUS GIESBRECHTI	Aetideus giesbrechti	Cleve, 1904
EUCHAETA NORVEGICA	Paraeuchaeta norvegica	(Boeck, 1872)
EUCHAETA TONSA	Paraeuchaeta tonsa	(Giesbrecht, 1895)
PSEUDAETIDEUS ARMATUS	Aetideopsis armata	(Boeck, 1872)
PARATHEMISTO ABYSSORUM	Themisto abyssorum	(Boeck, 1870)
PARATHEMISTO GAUDICHAUDII	Themisto gaudichaudii	Guerin-Meneville, 1
PARATHEMISTO LIBELLULA	Themisto libellula	(Lichtenstein, 1822)
MYSIDACEA	Lophogastridae	Sars, 1870
EUPHAUSIA KROHNI	Euphausia krohnii	(Brandt, 1851)
NYCTIPHANES COUCHI	Nyctiphanes couchii	(Bell, 1853)
THYSANOESSA RASCHI	Thysanoessa raschii	(M. Sars, 1864)
SAGITTA ELEGANS	Parasagitta elegans	(Verrill, 1873)
SAGITTA HEXAPTERA	Flaccisagitta hexaptera	(d'Orbigny, 1836)

These procedures can also extract the taxonomic hierarchy for the valid name.